

## SECTION 02600

### MANHOLES

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

The work covered by this Section relates to sanitary sewer manholes including types permitted, components, testing, and installation.

##### 1.2 TYPES PERMITTED

Standard manholes shall be circular in shape and shall be constructed of precast concrete manhole sections in general conformity with the Standard Detail Drawings. No consideration will be given to brick **manholes. Poured-in-place manholes and/or bases will be as approved by the Department.**

##### 1.3 STANDARDS

Where materials and methods are indicated in the following specifications as being in conformance with a standard specification, it shall refer in all cases to the latest edition of the standard specification and shall include all interim revisions. Listing of a standard specification without further reference indicates that the particular material or method shall conform with such listed specification.

##### 1.4 RELATED WORK SPECIFIED ELSEWHERE

Refer to following Sections of these Specifications for work related to this Section:

- A. Section 02221S – Trenching, Bedding and Backfilling for Sanitary Sewers (Gravity)
- B. Section 02722 – Sanitary Sewers (Gravity)
- C. Section 02724 – Sewage Force Main

#### PART 2 – PRODUCTS

##### 2.1 PRECAST CONCRETE MANHOLES

Precast concrete manholes shall conform to ASTM Designation C-478, latest revision and the Standard Detail Drawings. All precast, reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory approved by the Engineer prior to delivery to the site, and all materials that fail to conform to these specifications shall be rejected. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site, and shall be replaced at the Contractor's own

expense. Supply certified copies in duplicate of the inspection and acceptance reports of the testing laboratory to the Engineer before using the materials. The commercial testing laboratory shall be engaged and paid for by the Contractor.

## 2.2 MANHOLE JOINTS

Flexible plastic sealant for joints in precast manhole sections, grade rings and castings shall provide permanently flexible watertight joints, shall remain workable over a wide temperature range, and shall not shrink, harden, or oxidize upon aging. Material shall be butyl resin sealant ConSeal CS-102 or CS-202 as manufactured by Concrete Sealants, Inc. of New Carlisle, Ohio, RUB'R-NEK L-T-M manufactured by K. T. Snyder Co., Inc. of Houston, Texas, **BIDCO C-56 Joint Sealant manufactured by NPC of Park Hill, MO** or other approved equal. A minimum of two (2) strips of joint sealant shall be required at each joint **and shall conform to ASTM C990.**

## 2.3 NONSHRINK GROUT

Grout to be used for sealing around sewer pipes at manhole wall penetrations shall be a nonmetallic, nonshrink, flowable grout. The expansion which occurs to compensate for normal hydration shall not create stresses in the pipe or manhole wall. Material shall be premixed and ready to use with only the addition of water required and shall be equal to Burke nonmetallic grout or SonogROUT as manufactured by the Sonneborn Company. **This applies only to those penetrations where resilient rubber pipe to manhole connections are NOT used.**

## 2.4 RESILIENT PIPE CONNECTIONS AT MANHOLES

Resilient pipe connectors shall be manufactured in accordance with ASTM C-923 and shall consist of a durable rubber boot which shall be clamped securely to the cutout in the manhole wall and to the pipe by means of stainless steel clamps or bands **or cast into the manhole wall.** The void area between the pipe and the connector shall be sealed **on the inside only to the spring line of the pipe with grout or an approved flexible gasket material such as RUB'R-NEK L-T-M or an approved equal.** Resilient connectors shall be as manufactured by the **NPC, Inc.** KOR-N-SEAL Co. of Milford, New Hampshire, Press-Seal Gasket Corp., PRESS-BOOT of Fort Wayne, Indiana, **A-Lok Products of Tullytown, PA** or equal.

## 2.5 BRICK

Brick for repairing **existing brick** manholes shall be whole, new, hard burned, common building brick, meeting Grade MA of ASTM Specification Designation C32, latest revision. **Brick are no longer acceptable for adjusting manhole castings with new construction, only for repairs for existing infrastructure.** No salmon or soft brick will be accepted for use. They shall be of reasonable uniform and standard size with parallel edges and square corners. They shall be burned entirely through, free from cracks or flaws, tough and strong, and shall have a clear ring when struck together.

## 2.6 MORTAR

Mortar for repairing **existing** manholes, adjusting **existing** frames and castings or **existing** manhole inverts shall conform to the following:

A. CEMENT

Cement shall be Portland Cement, ASTM C-150, Type II.

B. MASONRY CEMENT

Masonry Cement shall be Brixment, or equal, conforming to ASTM C-91, Type II.

C. SAND

Sand shall be clean, natural river sand. When dry, one hundred (100%) percent of the sand shall pass a number eight (8) sieve, and not more than thirty-five (35%) percent shall pass a number fifty (50) sieve.

D. LIME

Lime shall be either hydrated or quicklime. Hydrated lime to be at least ninety-two (92%) percent hydrated. Quicklime must be able to pass a number twenty (20) sieve.

E. WATER

Water shall be clean and free of deleterious amounts of acids, alkalis, salts, or organic materials.

F. PROPORTIONS

Proportions shall be one (1) part Portland cement, three (3) parts sand, one-fourth (1/4) part lime or one (1) part Portland cement, one (1) part masonry cement, and six (6) parts sand.

## 2.7 MANHOLE FRAMES AND COVERS

Manhole castings shall conform to ASTM Designation A48, latest revision, Class 30B, and shall be free from scale, lumps, blisters, sand holes, and defects of every nature which would impair their use. Castings shall be well cleaned. Covers shall be of the solid type. Bearing surfaces of frames and covers shall be machined to provide a solid bearing and prevent rocking. Pattern drawings and weights of castings shall be submitted for the approval of the Engineer.

Manhole frames and covers shall be John Bouchard No. 1150 or equal. Watertight covers shall be similar except furnished with rubber gasket and stainless steel screws.

Submit a certificate from the manufacturer of the castings indicating that they meet all applicable requirements of these specifications.

## 2.8 MANHOLE STEPS

Manhole steps shall have an overall width of twelve (12") inches, shall be nonskid design, and shall be ductile iron equal to Neenah No. R-1982-F, or injection molded copolymer polypropylene plastic encapsulating a one-half (1/2") inch diameter grade sixty (60) steel reinforcing rod equal to number PS 1 with reflectors as manufactured by M.A. Industries, Inc., Peachtree City, Georgia or Press-Seal Gasket Corp., Fort Wayne, Indiana.

## 2.9 CONCRETE

Concrete of the respective classes for precast manholes, manhole bases, drop manholes, manhole vents, special manholes, etc. shall conform to the following:

### A. CEMENT

Cement shall be Portland cement of a brand approved by the Engineers, and shall conform to "Standard Specifications for Portland Cement", Type 1, ASTM Designation C150, latest revision.

### B. FINE AGGREGATE

Fine aggregate shall be clean, hard, uncoated sand conforming to ASTM Designation C33, latest revision, "Standard Specifications for Concrete Aggregate".

### C. COARSE AGGREGATE

Coarse aggregate shall consist of clean, hard, dense particles of stone or gravel conforming to ASTM Designation C33, latest revision, "Standard Specifications for Concrete Aggregate". Aggregate shall be well graded between one and one-half (1½") inches and number four (4) sieve sizes.

### D. WATER

Water used in mixing concrete shall be clean and free from organic matter, pollutants, and other foreign materials.

### E. READY-MIX CONCRETE

Ready-mix concrete shall be secured only from a source approved by the Engineers, and shall conform to ASTM Designation C94, latest revision, "Specifications for Ready-Mix Concrete". Before any concrete is delivered to the job site, the supplier must furnish a statement of the proportions of cement, fine

aggregate, and coarse aggregate to be used for each mix ordered, and must receive the Engineer's approval of such proportions.

F. CLASS "A" CONCRETE

Class "A" concrete shall have a minimum compressive strength of four thousand (4,000) pounds per square inch in twenty-eight (28) days and shall contain not less than six hundred (600) pounds of cement per cubic yard.

G. CLASS "B" CONCRETE

Class "B" concrete shall have a minimum compressive strength of three thousand (3,000) pounds per square inch in twenty-eight (28) days and shall contain not less than five hundred fifty (550) pounds of cement per cubic yard.

H. CORROSION RESISTANT ADDITIVE

Xypex ADMIX C-1000 (dye) or approved equal concrete waterproofing admix shall be added to the concrete during the batching operation to provide corrosion resistance. 3% of the required weight of Portland Cement shall be added as Xypex. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the Xypex ADMIX was added to the concrete. Colorant shall be added at the ADMIX manufacturing facility, not at the concrete batch plant. Xypex ADMIX must be added to the concrete at the time of batching. It is recommended that the ADMIX powder be added first to the rock and sand and blended thoroughly for 2-3 minutes before adding cement and water.

Blend total concrete mix using normal practices to ensure formation of homogeneous mixture.

PRECAST BATCH PLANT – PAN TYPE MIXER: Add Xypex ADMIX to the rock and sand, then mix thoroughly for 2-3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices.

FOR READY-MIX PLANTS – DRY BATCH OPERATION: Add Xypex ADMIX to the drum of the ready-mix truck in powder form. Then drive the truck under the batch plant and add 60%-70% of the required water along with 300-500 lb. (136-227 kg) of aggregate. Mix the materials for 2-3 minutes to ensure that the ADMIX is distributed evenly throughout the mix water. Then add the balance of materials to the ready-mix truck in accordance with standard batch practices.

FOR READY-MIX PLANTS – CENTRAL MIX OPERATION: Mix Xypex ADMIX with water to form a very thin slurry (e.g. 15-20 lb. of powder with 3 gallons of water), then pour the required amount of material into the drum of the ready-mix truck. The aggregate, cement and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity

of water that has been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of the ADMIX throughout the concrete.

## 2.10 STEEL REINFORCING

Reinforcing bars shall be intermediate grade steel conforming to ASTM Designation A15, latest revision, "Standard Specifications for Billet Steel Bars for Concrete Reinforcement". Bars shall be deformed with a cross sectional area at all points equal to that of plain bars of equal nominal size.

## PART 3 – EXECUTION

### 3.1 GENERAL

Only the use of precast concrete manholes will be permitted.

#### A. PRECAST MANHOLES

The Contractor shall submit details of the proposed manholes together with the name of the supplier to the Engineer for approval before any of the precast manholes are shipped to the job site. Precast manholes may be used with precast floors or with structural concrete floors poured-in-place. Precast risers shall be furnished with openings for pipes entering and leaving the manholes. Individual riser sections shall be furnished for the exact conditions to be encountered in the field and shall be constructed so as to suit field conditions and to line up properly with the pipes and manhole steps in other riser sections. The corbel section of the manhole shall be cast in the shape of a concentric cone unless indicated otherwise on the Plans. Misalignment of steps or improperly located holes for incoming pipes shall be cause for rejection of the manhole section. No pipe opening may be enlarged by use of sledgehammer or other impact type tool which could cause structural damage to the riser section. Precast manhole sections shall be joined together in such a way as to present a smooth, uniform joint which shall be structurally sound and watertight (See **Part 2-Par2.2**). **Approved manufacturer's of precast manholes are Cloud Concrete Products, Sherman Dixie Concrete Industries, Inc., Holton Concrete Products, LLC and Hampton Precast Concrete.**

#### B. SPECIAL MANHOLES

Where the size, number, or angle of pipes entering a manhole prevent the use of a standard four **through twelve (4', 5', 6', 8', 10', or 12')** foot diameter manhole, a special structure will be required. This special structure shall be built at the locations and in conformance with the details shown on the Plans and the applicable portions of these specifications.

Class "A" concrete shall be used, and reinforcing bars shall be intermediate grade steel conforming to ASTM Designation A15, latest revision, "Standard Specifications for Billet Steel Bars for Concrete Reinforcement".

Three (3) concrete test cylinders shall be made and tested for each separate concrete pour with one (1) being tested at seven (7) and two (2) being tested at twenty-eight (28) days. Sampling of concrete for test purposes shall be per ASTM C-172, latest revision, and testing of specimens shall be per ASTM C-39, latest revision. Testing shall be done by an independent testing laboratory engaged and paid for by the Contractor and approved by the Engineer.

### 3.2 FLOW CHANNELS

Flow channels for manholes shall consist of smooth, uniform cross sections conforming to the cross section of the pipes so as to provide a minimum of turbulence and avoid deposition of solids. Flow channels shall have a depth at least equal to eight-tenths (0.8) the pipe diameter. The finished floor of the manhole shall have a slope of approximately one-half (1/2") inch from wall to channel to provide for proper drainage, but at the same time offer a safe footing for workers.

### 3.3 SIZES AND HEIGHTS

Manholes shall be four **through twelve (4', 5', 6', 8', 10' or 12')** feet in diameter as determined by the pipe sizes and line deflections. Where necessary because of height restrictions, a shallow type manhole with a precast concrete cover slab may be used. The maximum height for a shallow type manhole shall be four (4') feet. This vertical centerline height shall be measured from the invert of the outlet pipe to the top of the manhole casting. Above this height, a manhole with a corbel section shall be installed. The access hole cast in the slab shall be located at the center of the slab. For manholes of five (5') through twelve (12') feet in diameter, a precast **transition** ring slab shall be used to seat the riser sections of the manhole. Riser sections for all sizes of manholes shall be four (4') feet in diameter. Manhole entrances shall be twenty-four (24") inches. **A minimum of six (6') feet of inside clearance is required between the bench and the bottom of the transition slab.**

The Contractor shall carefully order the precast manhole sidewall to meet the required field conditions. The height of the unit in place shall be such so as to allow a precast concrete grade ring to be placed on top of the manhole transition section prior to setting the casting.

### 3.4 MANHOLE STEPS

Manhole steps shall be **placed in-line over the bench** with even spacing of approximately sixteen (16") inches **maximum** between steps **and shall comply with OSHA subpart D "Fixed Ladders" section 1910-27 and/or ASTM C 478 Precast Reinforced Concrete Manholes Sections.** Manholes deeper than six (6') feet to be

located in paved streets where the top of the casting is flush with the pavement shall be provided with one (1) back-step set opposite the row of manhole steps.

### 3.5 DROP CONNECTIONS

Drop connections shall be built in manholes at the locations and in conformance with the details shown on the Standard Detail Drawing. The minimum size drop pipe shall be eight (8") inches. Generally, drop pipes shall be one size smaller than the sewer which they serve.

### 3.6 STUBOUTS

Stubouts for future extensions of the gravity sewer shall be built at the locations and grades shown on the Plans or as directed by the Engineer. Stubouts shall include a resilient pipe connector (see Section 2.4) and a two (2') foot section of plugged pipe installed in accordance with the specifications for bedding and backfilling for the type of pipe being installed as outlined in Section 02221S of these Specifications, Trenching, Bedding, and Backfilling for Sanitary Sewers (Gravity). The invert of the stubout shall be at the elevation shown on the Plans, but the flow channel for the stubout is not to be built in the manhole.

### 3.7 CONNECTIONS TO EXISTING MANHOLES

At locations where new sewers are shown to be connected to existing manholes, the Contractor may temporarily block and/or divert sewage flows to facilitate construction operations. No bypassing of sewage flows to ditches, streams, storm sewers, or the ground will be permitted. The work shall consist of making the opening in the manhole wall, inserting the new pipe and resilient connector to the elevation shown, constructing necessary drop connections, and remodeling manhole inverts. Openings in the manhole for the pipe shall be cored; the use of hammers will not be permitted. A resilient pipe connector (see Section 2.4) between the manhole and the pipes shall be installed in the cored opening. High-early strength cement shall be used for mortar in order that proper channels may be formed in manhole bottoms with a minimum interruption of service to the existing sewer.

### 3.8 CONNECTIONS TO NEW MANHOLES

All connections of pipe to new manholes shall be made with resilient connectors. Openings in the manhole sidewall for the pipe shall be precast or cored to provide required size and location. The hole shall be manufactured to allow for lateral and vertical movement, as well as angular adjustments through twenty (20°) degrees. A resilient connector between the manhole and pipes such as Kor-N-Seal or an approved equal shall be installed in the precast or cored opening. The resilient connector shall be molded from a **EDPM or polyisoprene** compound meeting requirements set forth in ASTM C923. An external band made entirely of corrosion resistant stainless steel shall be used to effect the seal around the pipe. The void between the pipe and the connector shall be filled **on the inside only with grout** to the spring line of the pipe or an approved flexible gasket material such as RUB'R-NEK L-T-M or an approved equal.



### 3.9 VENT PIPE ASSEMBLIES

At locations shown on the Plans or called for by the Engineer, vent pipe assemblies for manholes shall be installed in accordance with the Standard Detail Drawing and as herein specified.

The pipe shall be pressure Class 350 ductile iron pipe, cement mortar lined. Ductile iron pipe and fittings shall be cleaned with surface prep SP-1 (Solvent Clean) and shop primed with one (1) coat (2 to 3 mils) of alkyd-phenolic primer, H.B. Chem-Prime, Tnemec, or approved equal. The finish shall be one (1) coat (2 to 3 mils) of acrylic polyurethane enamel, Endura Shield 74 (gloss) or 75 (semi-gloss), Tnemec, or approved equal. The finish coat of paint shall be dark green.

The vent pipe shall be located as called for on the Plans.

The top of the vent pipe shall not be less than eight (8') feet above the existing ground line or set to the elevation as indicated on the Plans or as determined by the 100 year flood elevation.

Concrete foundation for manhole vent pipe assemblies shall be Class "A" concrete as specified in these Specifications. Forms will not be required unless the foundation is located in backfill materials.

### 3.10 FOUNDATIONS AND BASES

Dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during placement of the foundation.

Obtain an adequate foundation for all manhole structures by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or as directed by the Engineer.

Concrete manhole bases may be poured-in-place (**as approved by the Department**) or precast with the manhole sidewall conforming to the following requirements:

#### A. PRECAST MANHOLE BASES

All materials and methods used to precast manhole bases shall conform to the applicable provisions for precast manhole sidewall as set out in these Specifications.

The Contractor shall install the precast concrete manhole base upon a gravel (No. 67, 57, or approved equal) base that is a minimum of six (6") inches thick. This gravel base shall be carefully brought to the required grade. Care shall be taken that the gravel bed is level and even, so that when the precast unit is set in place the manhole sidewall will be installed plumb, and the concrete manhole base is in full contact upon the gravel base.

The precast manhole base shall be a minimum of six (6") inches in thickness.

Backfilling operations, as specified herein, may begin after the installation of the precast manhole sidewall with base has been completed. Upon completion of the backfilling operations, traffic may be allowed on the structure.

#### **B. POURED-IN-PLACE MANHOLE BASES**

Concrete for poured-in-place plain concrete base shall be Class "B" as specified herein.

All concrete shall be adequately protected from injurious action of the sun by keeping it wet, covering with water-saturated cover, or other methods approved by the Engineer.

In cold weather concrete shall be mixed and placed only when the temperature is at forty (40°) degrees F. or above, and rising, unless specifically authorized by the Engineer, in which event all materials shall be heated in a manner approved by the Engineer. In freezing weather, suitable means shall be provided for maintaining the concrete at a temperature of at least fifty (50°) degrees F. for a period not less than seventy-two (72) hours after placing, or until the concrete has hardened. Salt, chemicals, or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing, unless approved by the Engineer.

The poured-in-place manhole bases shall be allowed to set a minimum of twenty-four (24) hours before installing the manhole sidewall.

The monolithic concrete or the lower section of the precast ring sidewall shall be installed on the manhole base with a bond of cement mortar.

The bond shall be prepared by placing a "bead" of cement mortar, a minimum of three (3") inches thick, upon the manhole base and lowering the sidewall unit onto the mortar. The mortar forced from beneath the sidewall shall not be removed, but shall be troweled to the manhole sidewall to form a fillet or chamfer around the base of the sidewall.

Care shall be taken to insure that the manhole sidewall is installed plumb and truly vertical. To this end the Contractor shall take care, when pouring the concrete manhole base, to finish it to a horizontal surface.

When approved by the Engineer, the manhole sidewall may be set on concrete block supports and the required base poured up to and around the manhole sidewall. The base shall then be allowed to set for twenty-four (24) hours. Care shall be taken to prevent concrete being poured up to or around the resilient pipeline connector.

### **3.11 WATERPROOFING**

**This section has been completely omitted due to the Xypex ADMIX C-1000 additive that is mixed with the precast process.**

### 3.12 CASTINGS

Carefully set the cast iron frame for the cover at the required elevation, and properly bond it to the masonry with cement grout and/or anchor bolts. Wherever manholes are constructed in paved areas, tilt the top surface of the frame and cover so as to conform to the exact slope, crown, and grade of the existing adjacent pavement. Whenever manhole castings are set more than two (2") inches above the base/binder because the final surface is to be added later, place, stabilize with sand bags and maintain a drum barricade on the manhole casting as described in the Manual on Uniform Traffic Devices, Part 6.

### 3.13 BACKFILLING

Place backfill by hand around the manhole and to a distance of at least one pipe length into each trench, and tamp with clean crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, up to an elevation of twelve (12") inches above the crown on all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

### 3.14 TESTING & ACCEPTANCE

**It will be required that all manholes be subjected to a vacuum test of at least 10" Hg. prior to acceptance by Murfreesboro Water and Sewer Department. The test shall be considered acceptable if the vacuum remains at ten (10") inches Hg. or the time to drop to nine (9") inches Hg. is greater than sixty (60) seconds for four (4') foot diameter, seventy-five (75) seconds for five (5') foot diameter, and ninety (90) seconds for six (6') foot diameter manholes.**

If the manhole fails the initial test, the Contractor shall locate the leak and make appropriate repairs, acceptable to the Engineer, in preparation for additional tests.

The Contractor will be required to furnish all equipment necessary for this test including the manhole sealing apparatus, gauges, pump, plugs, and operating personnel.

**The manholes and castings will not be accepted by the Department until binder is installed around the casting within the proposed roadway or the ground is to finished grade outside the proposed roadway.**

END OF SECTION 02600